6.2 Notes and Examples   Name: Block: Seat:

Solving Differential Equations

1. Warm Up (from ΔMath): Consider the differential equation $\frac{dy}{dx} = x(3 + 2y)$ with a particular solution $y = f(x)$ having an initial condition $y(-4) = -2$ Use the equation of the line tangent to the graph of f at the point $(-4, -2)$ in order to approximate the value of $f(-4.1)$.

2. (a) A differential equation is an equation involving a ________________________

   (b) So far you have solved differentiable equations of the form ______________ and ______________

   (c) In this section we lear to handle a more general type, where $\frac{dy}{dx}$ is a relation between _____ and _____.

   (d) Last section we used _______________________ to find general and particular solutions graphically.

   but in this sections we will use an analytic strategy called called ______________________________________

3. How to find a general and particular solutions to a differential equation analytically:

   (a) Collect terms: ____________________________

   (b) ____________________________ both sides, but only one _________ on one side is needed.

   (c) For the general solution, solve for _________

   (d) For a particular solution that passes through a particular point , substitute the _____________ into

   the general solution, and solve for _______. Don't forget to write your final solution in terms of _____

4. Find the general solution of the differential equation $y' = \frac{2x}{y}$

5. Find the general solution of the differential equation $y' = -\dfrac{\sqrt{x}}{3y}$

6. Find the general solution of the differential equation $xy + y' = 16x$

7. Find the function $f(t)$ passing through the point $(0, 10)$ and has the derivative $\frac{dy}{dt} = \frac{t^2}{y}$ (When your have your equation check with your TI or Desmos `https://www.desmos.com/calculator/p7vd3cdmei`)

8. In many applications, the rate of change of a variable y is proportional to the value of y, and a constant (usually k or r). In algebra and science classes we are just told to memorize a formula. Now we can derive it! If the rate of change of y is proportional, then we can start with $\frac{dy}{dt} = ky$ or $\frac{dy}{dt} = ry$. Now we can solve this differential equation to find a familiar formula:

9. The rate of decay of radium is proportional to the amount present at any time. If 60 mg of radium are present now and its half-life is is 1690 years, how much radium will be present 100 years from now?
   (a) Think of three data points of a function $r(t)$ that maps year to mg of radium:
   (b) It's proportial, so we use $\frac{dr}{dt} = kr$, solve for r.
   (c) Next solve for C using one of the data points
   (d) Next solve for k using the other data point
   (e) Finally we find $r(100)$